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SOME MOBILE PHONE ASSOCIATED HEALTH PROBLEMS AMONG MOBILE PHONE WORKERS AT ZAGAZIG CITY, SHARKIA GOVERNORATE

By

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ABSTRACT

Background: Although mobile telecommunications deliver enormous benefit to society, there are concerns whether its electric and magnetic field emissions are linked with cancer or other health hazards. **Objectives:** 1) determining some of the mobile phone(Mph) associated health problems. 2) identifying some of the risk factors associated with exposure to Mph. **Subjects and methods:** A comparative cross-sectional study was conducted on 125 workers in mobile phone shops at Zagazig City, Sharkia Governorate and non-exposed control group consisted of 119 Mph users group and 29 Mph nonusers group. All workers were interviewed using a pre-designed questionnaire including sociodemographic data, occupational history, Mph exposure & health complaints experienced during Mph working period and all workers were subjected to blood pressure measurement. **Results:** The results revealed that, the prevalence of sleep disturbances and tension was significantly higher in Mph workers (48.8% & 60.0%) compared to Mph non-users control group (17.2%, 31.0% and P<0.001), while the prevalence of recurrent migraine was significantly higher in Mph workers (27.2%) compared to their controls (16.4%, 6.9% and P<0.05). The prevalence of earache, pain with heat sensation around the ear and eye allergy was significantly higher in Mph workers (7.2%, 30.4% and 17.6%) compared to Mph us-

ers control group (1.7%, 18.1% and 6.3% and P<0.05 & P<0.01 respectively), while there were no significant differences between Mph workers and their controls as regard blood pressure measurement, cardiovascular complaints and occurrence of traffic accidents during using Mph while driving. The prevalence of sleep disturbances, pain with heat sensation around the ear and eye allergy were significantly increased with increasing Mph work duration in months and the total duration of exposure to Mphs in hours among Mph workers.

Conclusion and recommendations: Working with Mphs led to increase in the prevalence of some health problems in the nervous system, ear, and eye among Mph workers. Sleep disturbances, pain with heat sensation around ear and eye allergy were increased with increasing Mph work duration in months and the total duration of exposure to Mphs. Mph workers must know about the common sense basis for reducing their exposure to Mphs through public information campaigns. Replication of the study on a large scale with other types of epidemiological studies are needed for further establishment of the perceived health effects among Mph workers.

Introduction

Mobile phones (Mphs) are low power, single-channel, two-way radio devices that transmit and receive radio frequency radiation[1]. The widespread use of mobile phones has been going sky-high over the past decade and now its use is an essential part of business, commerce and society[2]. By early 2000, the number of subscribers to cellular telephone services had grown to an estimated 92 million in the United States, and over two milliar and half worldwide[3], while Ghietas, (2007) [4] reported over 22 million Mph users In Egypt and this use will continue to increase for the foreseeable future[2].

Although mobile communications deliver enormous benefit to society, there are concerns whether the electric and magnetic field (EMF) emissions associated with the delivery of this benefit are linked to cancer or other health hazards[5].

Experimental studies reveal that EMF emitted by cellular telephones may be responsible for deleterious effects on cognitive functions[6,7], periodical increase in arterial blood pressure[6,8] and can cause damage to the nerves around ears[9] and blood brain barrier[9,10]. Also epidemiological studies reveal an association between cellular telephones and brain tumour[11,12,13,14,15], infertility and negative

reproductive outcomes [16,17,18,19]. While, other studies indicates that mobile phone is safe for humans[20] and there are no effects of exposure to mobile phone RF on the body systems[21,22,23,24,25].

In order to assess the possible health effects of this new technology in Egypt, only very few small scale epidemiological studies[26,27] were conducted and concerned with Mph use exposure, while so far no research was published in Egypt concerning with exposure to Mphs among Mph workers.

So, this study was conducted to: 1) determine some of the Mph associated health problems. 2) identify the risk factors associated with exposure to Mph among workers in mobile phone shops.

Subjects and Methods

Study design and setting:

A comparative cross-sectional study was carried out during the period from January to March 2007 at the Mph shops of El-Quomyia zone in Zagazig City, Sharkia Governorate.

Target Population: The target population included two groups of male subjects: one group included 125 workers in mobile phone shops dealing with and exposed to RF radiation from using mobile phones during making calls, activation of the card, transmission of tones, sending messages and maintenance process. The other group consisted of 145 workers, working in shops nearby Mph shops and not working with Mphs, were selected randomly and considered as a control group. Because of the wide use of Mphs now, it was difficult to find a control group without exposure to mobile phone, so the control group was further subdivided into two groups:

-Mph users group who used Mph.

-Mph nonusers group who did not use Mph at all. Therefore the number of participating persons in the control groups were 116 for Mph users and 29 for non users of Mph.

Sample selection: Zagazig City has been divided into 2 divisions (first and second division) which contain 562 mobile phone shops. The second division was randomly selected which further subdivided into four zones(City Council), where El-Quomyia zone was randomly selected and all mobile phone workers in all shops were involved in the study to fulfill the sample size.

Sample size: Assuming the prevalence of headache was 23% according to a pilot study done at the begining of the study, at a confidence interval of 95%, degree of precision of 70% and a population size of about 562 mobile phone workers, the sample size was calculated to be about 114 mobile phone workers done by Epi-Info (Epidemiological Information Package) software version 6.1[28]. However some mobile phone shops had more than one and 2 workers(all want to participate) so, the total size of the participating workers reached 125 Mph workers at mobile phone shops at Zagazig City.

Data collection (Methods):

All participants in the study were subjected to the followings:

(A)Questionnaire: A pre-designed questionnaire was used to collect information about the possible Mph health complaints.

Pilot study: A pilot study was carried out during October 2006 and November 2006 in mobile phone shops at the first and second division in Zagazig City. The pilot sample included 17 Mph workers which were interviewed to test the different items of the questionnaire and detect the prevalence of some health problems among Mph workers due to their exposure to Mph. After the pilot study was completed, minor modifications were made in the questionnaire.

The questionnaire included two parts, the first part included questions that all participants should answer, while the second contained questions about exposure to the mobile phone.

Part I: This part included:

1-Sociodemographic data about age, level of education, marital status and smoking habit.

2-Questions about health complaints experienced during the working period (once or more per week) in the last year at least. It included:

-Complaints related to the general health status, neurobehavioral, and local skin symptoms at the side of the face or around the ear.

-Complaints related to the ear, eye and cardiovascular system.

- Presence of certain benign tumors or malignant cancers.

Part II: It included questions about exposure to mobile phone:

1- Type of Mph and pattern of its use.

2- Data about Mph exposure: it included

-Frequency of Mph calls/day.

-Duration of each call in minutes/day.

-Duration of all calls in minutes/day= frequency of Mph calls/day x duration of each call in minutes/day.

3-Occupational history in Mph workers:

-Duration of work with Mphs in months.

-Duration of actual work with Mph in hours/day(duration of Mph exposure in hours/day) which is the period of contact with Mphs during making calls, activation of the card, transmission of tones, sending messages and maintenance processes{= (duration of total calls in minutes/day + duration of contact with the Mph in minutes /day)/60}.

-Duration of Mph exposure in hours/ month=duration of Mph exposure in hour/ day x work days/month).

-Total duration of Mph exposure due to working with Mphs in hours = the duration of work with Mphs in months x duration of exposure to Mphs in hours/month.

4-Opinion about relation of Mph to health hazards and measures taken to avoid or decrease its effects on health.

(B) Screening for blood pressure(B.p) level among mobile phone workers: every Mph worker in the study was submitted to B.p measurement and he was considered normal if B.p was<120/80, hypertensive if it was >120/80 and hypotensive if it was< 90/60[29].

Data management and analysis: The collected data were computerized and statistically analyzed using Epi-Info software version 6.1[28] and (SPSS (Statistical Package for Special Sciences) version 11.0[30]. The qualitative data were evaluated using chi-squared test (χ^2) whenever possible; otherwise "Fisher exact test" was done when expected cell is less than five. Student's t-test was used for comparison between quantitative data. The significance level was considered at P-value < 0.05.

Results

Table (1) This table shows that Mph workers had a significant long duration (>48 months) of using mobile phone in work than the Mph users' control group (P<0.001). Also a high percent of Mph workers were significantly using the Mphs for >10 times/day(64.8%), for >3 minutes as a call duration/day(64.0%) and for >30 minutes /day as a total duration of calls per day(64.8%) when compared to Mph users

and control group(16.4%, 20.7%, 20.7% and P<0.001).

From the results of the study, 64 (51.2%) of Mph workers were exposed to Mphs in work for >8 hours/day, while 61 (48.8%) of them were exposed to Mphs for ≤8 hours/day. Also the total duration of Mph exposure due to working with Mphs in hours (which equals the duration of work with Mphs in months x duration of exposure to Mphs in hours/month) was as follow: 43 (34.4%) of Mph workers were totally exposed to Mphs in their work for ≤ 9984 hours, while 82(65.6%) were totally exposed to Mphs in their work for > 9984 hours.

Table (2) shows that, 17.6% of Mph workers carrying their Mph in hands, and 9.6% carry it in more than one place, which were significantly higher than the control group (7.8%, 1.7% and P<0.05 & P<0.01 respectively). On the other side, 83.6% of the control group were carrying the Mph around their waist and 24.1% of them were using more than control measure to protect them from Mph, which were higher than Mph workers(P<0.001). Otherwise, there were no significant differences between them regarding other options and precautions.

Table (3) shows that, Mph workers were complaining from some general health and neurobehavioral symptoms more than their controls, as the frequencies of sleep disturbances (48.8%) and tension (60.0%), were significantly higher in Mph workers compared to Mph non-users control group(17.2%, 31.0% and P<0.001). Also the frequency of recurrent migraine was significantly higher in Mph workers (27.2%) compared to Mph users and non-users control groups(16.4%, 6.9% and P<0.05). On the other side, the frequency of sleep disturbances and tension were significantly higher among users of Mph (42.2% and 56.9%) than among non-users of Mph(17.2%, 31.0% and P<0.05). Otherwise there were no significant differences between the three groups regarding the other complaints.

Table (4) shows that Mph workers were complaining from some ear and eye symptoms more than their controls, as the frequencies of earache, pain with heat sensation around the ear and eye allergy were significantly higher in Mph workers(7.2%, 30.4% and 17.6%) compared to Mph users control group (1.7%, 18.1% and 6.3% and P<0.05 & P<0.01 respectively). Otherwise, there were no significant differences between the three groups regarding cardio-

vascular or other complaints and in the occurrence of traffic accidents while using Mph during driving.

Table (5) shows that, there were no statistical significant differences between Mph workers and their control groups (Mph users and non users) as regard blood pressure outcome(P>0.05).

Table (6) shows that, on studying the effect of duration of work with Mphs in months on the frequencies of the general health, neurobehavioral, ear and eye complaints among Mph workers, it was found that, Mph workers working with mobile phone for >48months had a significant higher prevalence of sleep disturbances, pain with heat sensations around ear and eye allergy (56.1%, 29.3% and 24.4%), compared to those working with mobile phones for 48months (34.9%, 32.6% and 4.7% and P<0.05 & P<0.01 respectively), while there were no statistical significant differences between them regarding the other complaints(P>0.05).

Table (7) reveals that, on studying the effect of the duration of all calls in minutes per day on the frequencies of general health, neurobehavioral, ear and eye complaints among mobile phone workers, it was found that, there were no statistical significant differences in the prevalence of these complaints between Mph workers with calls duration (30 minutes/day and those with calls duration >30 minutes/day (P>0.05).

Table (8) shows that, on studying the effect of duration of Mph exposure in hours/day(duration of actual work with Mph/ day) on some general health, neurobehavioral, ear and eye complaints among Mph workers, no statistical significant differences were found in the prevalence of these complaints between Mph workers who exposed to Mph for (8hr/day and those who exposed to Mph for >8hr/day (P>0.05). Table (9) shows that, there were some effects of the total duration of exposure to Mphs in hours (since working with Mphs) on the frequencies of some neurobehavioral complaints among Mph workers, where the prevalence of sleep disturbances, pain with heat sensations around ear and eye allergy increase significantly with increasing total duration of Mph exposure among Mph workers(P<0.05), while there are no significant effects of the total duration of Mph exposure on the prevalence of other complaints (P>0.05).

NB: no cancer cases were found in this study

Table (1) Some parameters of Mph use among workers and Mph users.

Mph use parameters	Mph workers N=125 No	%	Control group (Mph users)N= 116 No	%	P-value
Duration of work(use) with Mph/ month :					
< 48 months	43	34.4	70	60.3	0.000**
> 48 months	82	65.6	46	39.7	
Frequency of Mph calls/day:					
<10times/day	44	35.2	97	83..6	0.000**
>10 times/day	81	64.8	19	16.4	
Average duration of each call/ min/ day:					
< 3 minutes/day	45	36.0	92	79.3	0.000**
> 3 minutes/day	80	64.0	24	20.7	
Duration of calls /day					
< 30 minutes/day	44	35.2	92	79.3	0.000**
> 30 minutes/day	81	64.8	24	20.7	
Duration of Mph exposure in work in hours/day:					
< 8 hours/day	61	48.8			
> 8 hours/day	64	51.2			
Total duration of Mph exposure due to working with Mphs in hours*:					
< 9984 hours	43	34.4			
> 9984 hours	82	65.6			

*=duration of work with Mphs in months x duration of exposure to Mphs in hours/month.

** P<0.001

Table (2) Options and precautions during using Mph among workers and Mph users.

Options and precautions	Mph workers N=125	Control group (Mph users) N= 116	P-value
	No	(%)	
Using hand free kits	31 (12.9)	24 (20.7)	0.447
Use Mph while driving	37 (29.6)	23 (19.8)	0.079
Where carrying Mph:			
-Hand	22(17.6)	9 (7.8)	0.022*
-Pocket	6 (4.8)	3 (2.6)	0.502
-Nearby place	8 (6.4)	4 (3.4)	0.292
-Bag	1 (0.8)	1 (0.9)	1.00
-Around the waist	76 (60.8)	97(83.6)	0.000***
-More than one	12 (9.6)	2 (1.7)	0.009**
Believing that Mph has health hazards:			
-Believing	85(68.0)	84(72.4)	0.454
-Don't believe	35(28.0)	27(23.3)	0.401
-Don't know	5(4.0)	5(4.3)	1.00
Using control measures:			
-Not use measures	48(38.4)	37(31.9)	0.291
-Decrease time of use	27(21.6)	25(21.6)	0.992
-Using ear piece	10(8.0)	4(3.4)	0.131
-Keeping away from head	27(21.6)	22(18.9)	0.611
-More than measure	13(10.4)	28(24.1)	0.004***

* P<0.05 ** P<0.01 ***P<0.001

Table (3): Distribution of general health and neurobehavioral complaints among Mph workers and control groups.

General health & neuro-behavioral complaints	Mph work-ers N=125		Controls(N=145)				P1	P2	P3
			Mphusers N=116		Non-users N= 29				
	No	(%)	No	(%)	No	(%)			
Sleep disturbances	61	48.8	49	42.2	5	17.2	0.307	0.002***	0.012**
Tiredness	36	28.8	30	25.9	6	20.7	0.609	0.377	0.564
Tension	75	60.0	66	56.9	9	31.0	0.625	0.004***	0.012**
Vertigo	31	24.8	26	22.4	3	10.3	0.663	0.091	0.146
Nausea &vomiting	17	13.6	12	10.3	3	10.3	0.438	0.767	1.0
Anorexia	37	29.6	22	19.0	4	13.8	0.055	0.083	0.516
Recurrent headache	45	36.0	32	27.6	6	20.7	0.162	0.114	0.450
Recurrent migraine	34	27.2	19	16.4	2	6.9	0.043*	0.019*	0.249
Amnesia	56	44.8	50	43.1	8	27.6	0.791	0.090	0.127
Numbness& parathesia at the side of the face	13	10.4	12	10.3	1	3.4	0.989	0.470	0.465

-P1=Mph workers vs. Mph users (control group) * P<0.05 ** P<0.01 ***P<0.001

-P2= Mph workers vs. Mph non-users (control group)

-P3= Mph users (control group) vs. Mph non-users (control group)

Table (4): Distribution of ear, eye, cardiovascular complaints and traffic accidents while driving among Mph workers and control groups.

Ear, Eye & cardiovascular complaints	Mph workers N=125		Controls(N=145)				P1	P2	P3
			Mphusers N=116		Non-users N= 29				
	No	(%)	No	(%)	No	(%)			
Ear complaints									
Decrease hearing	6	4.8	4	3.4	1	3.4	0.750	1.00	1.00
Earache	9	7.2	2	1.7	1	3.4	0.041*	0.688	0.490
Tinnitus	15	12.0	13	11.2	0	0.0	0.847	0.075	0.071
Ear allergy	13	10.4	9	7.7	2	6.9	0.476	0.738	1.00
Pain & heat sensation									
around ear	38	30.4	21	18.1	7	24.1	0.026*	0.504	0.461
Allergy around ear	12	9.6	13	11.2	1	3.4	0.682	0.464	0.302
Eye complaints									
Ocular Pain	5	4.0	0	0.0	0	0.0	0.060	0.273	---
Eye allergy	22	17.6	7	6.3	1	3.4	0.005**	0.054	0.585
Cardiovascular complaints									
Hypertension	1	0.8	2	1.7	1	3.4	0.609	0.342	0.490
Hypotension	2	1.6	1	0.9	1	3.4	1.00	0.467	0.361
Angina pain	1	0.8	1	0.9	1	3.4	1.00	0.342	0.361
Traffic accidents while using Mph	N=37***		N=23***						
	2	5.4	1	4.3					

-P1= Mph workers vs. Mph users (control group). * P<0.05 ** P<0.01

-P2= Mph workers vs. Mph non-users (control group). *** Number of drivers

-P3= Mph users (control group) vs. Mph non-users (control group).

Table (5): Blood pressure outcome among the study groups.

Blood pressure outcome	Mph workers N=125		Controls(N=145)				P1	P2	P3
			Mphusers N=116		Non-users N= 29				
	No	(%)	No	(%)	No	(%)			
Normal	114	91.2	101	87.1	24	82.8	0.301	0.185	0.552
Hypotension	3	2.4	5	4.3	3	10.3	0.486	0.081	0.198
Hypertension	8	6.4	10	8.6	2	6.9	0.512	1.00	1.00

-P1= Mph workers vs. Mph users (control group).

-P2= Mph workers vs. Mph non-users (control group).

-P3= Mph users (control group) vs. Mph non-users (control group).

Table (6): Distribution of general health, neurobehavioral, ear and eye complaints among Mph workers according to duration of work with Mphs in months.

Complaints	Duration of work with Mphs in months in Mph workers (N=125)				χ^2	P-value
	≤ 48 months N=43		≥ 48 months N=82			
	No	(%)	No	(%)		
General & neuro-behavioral complaints						
Sleep disturbances	15	34.9	46	56.1	5.08	0.024*
Tension	24	55.8	51	62.2	0.48	0.489
Recurrent migraine	12	27.9	22	26.8	0.02	0.898
Ear complaints					Fisher	
Earache	2	4.7	7	8.5	exact test	0.717
Pain& heat sensations around ear	8	32.6	30	29.3	4.31	0.037*
Eye complaints						
Eye allergy	2	4.7	20	24.4	7.58	0.006**

* P<0.05 ** P<0.01

Table (7): Distribution of some general health, neurobehavioral, ear and eye complaints among Mph users according to duration of all calls in minutes per day.

Complaints	Duration of work with Mphs in months in Mph workers (N=125)				χ^2	P-value
	≤ 30 min /dayN=44		> 30 min /day N=81			
	No	(%)	No	(%)		
General health& neurobehavioral complaints						
Sleep disturbances	17	38.6	44	54.3	2.81	0.093
Tension	24	54.5	51	63.0	0.84	0.358
Recurrent migraine	8	18.2	26	32.1	2.79	0.094
Ear complaints						
Earache	4	9.1	5	6.2	Fisher exact test	0.718
Pain& heat sensation around ear	9	20.5	29	35.8	3.17	0.074
Eye complaints						
Eye allergy	5	11.4	17	21.0	1.82	0.177

* min= minute

Table (8):Distribution of general health, neurobehavioral, eye and ear complaints among mph workers according to duration of exposure to mobile phone/ day.

Complaints	Duration of exposure to Mph in hours/ day* in Mph workers (N=125)				χ^2	P-value
	≤ 8 hours/day N=61		> 8 hours/day N=64			
	No	(%)	No	(%)		
General health& neurobehavioral complaints						
Sleep disturbances	28	45.9	33	51.6	0.401	0.527
Tension	32	52.5	43	70.5	2.82	0.092
Recurrent migraine	15	24.6	19	29.7	0.41	0.522
Ear complaints						
Earache	6	9.8	3	4.7	Fisher exact test	0.316
Pain& heat sensation around ear	18	29.5	20	31.3	0.045	0.832
Eye complaints						
Eye allergy	11	18.0	11	17.2	0.015	0.901

* =duration of total calls /day + duration of contact with the Mph /day .

Table (9):Distribution of some general health, neurobehavioral, ear and eye complaints among Mph workers according to total duration of Mph exposure.

Complaints	Total duration of Mph exposure in hours** in Mph workers(N=125)				χ^2	P-value
	≤ 9984 hour N=43		> 9984 hour N=82			
	No	(%)	No	(%)		
General health& neurobehavioral complaints						
Sleep disturbances	15	34.9	46	56.1	5.08	0.024*
Tension	23	53.5	52	63.4	1.16	0.281
Recurrent migraine	10	23.3	24	29.3	0.51	0.472
Ear complaints						
Earache	2	4.7	7	8.5	Fisher exact test	0.717
Pain& heat sensation around ear	8	18.6	30	36.6	4.31	0.037*
Eye complaints						
Eye allergy	3	7.0	19	23.2	5.10	0.023*

**=duration of work with Mphs in months x duration of exposure to Mphs in hour/month.

* P<0.05

Discussion

Parallel to the increase in the utilization and popularity of mobile telephony, the population's concerns for the effects on health attributable to electromagnetic radiation emitted by Mphs and their base stations(BSts) have also grown. Given the immense number of users, even small adverse effects on health could have significant public health implications. The possibility of health risks is mainly related to the fact that Mphs are held adjacent to the head and very close the body[31].

So, this study was done to determine some of mobile phone associated health problems, estimate their prevalence and identify the risk factors associated with exposure to mobile phone among mobile phone workers at Zagazig City, Sharkia Governorate.

General characteristics of the study groups: The study groups were matched as regard age, educational level, marital status and smoking habit.

Some parameters and precautions of Mph use in the study groups: A high percent of Mph workers in this study were significantly using the Mphs for >10 times/day, for >3 minutes as average call duration/day, and for > 30 minutes /day as a total duration of calls per day when compared to Mph users (P<0.001). 64 of Mph workers (51.2%) were exposed to Mphs for >8 hours/day, while 61(48.8%) of them were exposed to Mphs for ≤8 hours/day. Also 43 of Mph workers (34.4 %) were totally exposed to Mphs in their work for ≤9984 hours, while 82(65.6 %) were totally exposed to Mphs in their work for >9984 hour. Also 17.6% of Mph workers carrying their Mph in hands, and 9.6% carry it in more than one place, which were significantly higher than the Mph users control group. On the other side, 83.6% of the Mph users control group were carrying the Mph around their waist and 24.1% of them were using more than control measure to protect them from Mph, which were significantly higher than Mph workers (P<0.001).

Effects of working with Mph on health:

1-Effects on general health and nervous system: The results of the study revealed that, Mph workers were complaining from some neurobehavioral symptoms more than their controls, where sleep disturbances (48.8%) and tension (60.0%), were significantly higher in Mph workers compared to Mph non-users control group (17.2%, 31.0% and P<0.001), and recurrent migraine was significantly higher in

Mph workers (27.2%) compared to Mph users and non-users control groups(16.4%, 6.9% and P<0.05). On the other side, the frequencies of sleep disturbances and tension were significantly higher among users of Mphs (42.2%, 56.9% and P<0.05) than among non-users of Mphs. These results are consistent with Mousa (2005)[26] and Salama & Abo El-Naga (2004)[32] who reported that the health effects that were mostly reported by Mphs users were the neurological symptoms as sleep disturbances, frequent migraine and tension. Also, Hardell et al., (2002a,b) [11,12] reported that mobile phones double the risk of increasing brain activity during sleep among users.

Otherwise there are no significant differences between the three groups regarding the other complaints, these results are consistent with Lorrian and Raoul (2005) [33] and Alhbom et al. (2004b)[19] who reported absence of subjective symptoms such as headache, tiredness, fatigue and local symptoms among volunteers exposed to Mph RF radiation. In contrast to this study, Chia et al. (2000)[34] reported that there was a significant increase in the prevalence of headache only among users than among non users of mobile telephony.

2-Effects on ear and eye: The results of the present study revealed that, working with Mph had some health effects on ear and eye, as Mph workers were complaining from some ear symptoms more than their controls, where the frequencies of earache and pain with heat sensation around the ear were significantly higher in Mph workers(7.2%, and 30.4%) compared to Mph users control group (1.7%, 18.1% and P<0.05 respectively). This is in accordance with Oftedal et al.(2000)[35] and Sandstorm et al. (2001)[36], who reported that 11.3% and 47% of Mph workers in Sweden and Norway respectively were complaining from warmth behind and on the ear. Also local ear symptoms including earache and pain & heat sensation around ear were significantly increased in Mph users[26,32,37]. Mph workers in this study were complaining from some eye symptoms more than their controls, as the frequency of eye allergy was significantly higher in Mph workers(17.6%) compared to Mph users (6.3% and P<0.01), while there were no significant differences between the three groups of the study regarding ocular pain. These results are in agreement with Balik et al. (2005)[38] and Hocking et al.(1998)[39], who reported that eye inflammation was the most prevalent

symptoms among Mph users, while in contrast, Mousa (2005)[26] reported that there were no significant differences for eye symptoms among Mph users and control group.

3-Effects on cardiovascular system (CVS): Working with Mph in this study had no effects on cardiovascular system and blood pressure measurements, as there were no significant differences between the three groups regarding cardiovascular complaints and blood pressure measurements. This is in accordance with Health Council of the Netherlands (2002)[25] and in opposite with ARPANSA (2004)[6] who reported decrease in the heart rate and elevation of both systolic and diastolic blood pressure by 5-10 mmHg in human volunteers exposed to Mph positioned close to the right side of the head than non exposed control group. Also a high percent of CVS complaints as ischemic heart pain, changes in blood pressure and heart rate were significantly higher among those exposed to base stations[40,41]. The absence of significant association of Mph exposure to other complaints among Mph workers may be due to short duration for this new job and the young age of this study workers as the mean age of Mph workers was 27.76±7.03.

4-Effects of Mph use while driving on traffic accidents: In this study, there were no significant differences between Mph workers and their controls (Mph users) in the occurrence of traffic accidents while using their Mph during driving. These results match with ARPANSA (2004)[6], while Strayer et al. (2001)[42] and Sienkiewicz et al. (2005)[43] reported significant increase in accidents with those using Mph while driving than controls, which may be due to reduction in driver attention and performance associated with conducting the call itself.

Effect of some Mph use parameters on the occurrence of Mph health effects among Mph workers:

1-Total working duration with Mphs in months: Our results revealed that Mph workers working with mobile phones for > 48 months had a significant high prevalence of sleep disturbances, pain with heat sensations around ear and eye allergy (56.1%, 29.3% and 24.4%), compared to those working with mobile phones for (48months(34.9%, 32.6% and 4.7% and $P<0.05$ & $P<0.01$ respectively). In agreement with our study, Balik et al. (2005)[38] reported statistical evidences that long term use of Mph may cause blurring of vision, inflammation and lacrimation of the

eyes. Also sleep disturbances and heat sensation at the side of the face among Mph users were mostly related to the duration of total exposure to Mphs[26,32]. On the other side, Chia et al.(2000)[34] reported no link of Mph use was found with local eye and ear symptoms and cognitive capacities are not adversely affected, even when a mobile telephony is frequently used and for a long duration[25].

2-Duration of all calls in minutes per day: Studying the effect of the calls duration in minutes per day on the frequencies of general health, neurobehavioral, ear and eye complaints among mobile phone workers, this study found that, there were no statistical significant differences in the occurrence of these complaints between Mph workers with calls duration (30 min/ day and those with calls duration >30 min/ day($P>0.05$). This is in agreement with Al-Khlaiwi(2004)[2] in Saudi Arabia, while other studies found that, the total duration of Mph use was significantly associated with heat sensation around the face, decrease in cognitive functions and minor effects on sleep[34,36,44]. Also decreased hearing, tinnitus and earache among Mph users were significantly associated with the total Mph use[37,45].

3-Duration of exposure to Mph in hours per day: On studying the effect of duration of Mph exposure/day on some general health, neurobehavioral, ear and eye complaints among Mph workers, no statistical significant differences were found in the occurrence of these complaints between Mph workers who exposed to Mph for (8hours/day and those who exposed to Mph for >8hours/ day. This in accordance with Koivisto et al. (2001)[46] and Health Council of the Netherlands (2002)[25], but in contrast with a study reported that the duration of Mph calls per day was the principle parameter affecting many health effects[26].

4-Total duration of Mph exposure in hours: This study revealed that there were some effects of the total duration of exposure to Mphs in hours(since working with Mphs) on the frequencies of some neurobehavioral complaints among Mph workers, where the prevalence of sleep disturbances, pain & heat sensations around ear and eye allergy increased significantly with increasing duration of Mph exposure among Mph workers($P<0.05$). These are in accordance with other studies who found that the general and local symptoms including sleep disturbances and heat sensation at the side of the face among Mph us-

ers were mostly related to the duration of total exposure to Mphs[26,32]. Otherwise, there are no significant effects of the total duration of Mph exposure on the other complaints (P>0.05). This is inconsistent with other studies who showed insignificant associations between using Mph for longer periods and fatigue and other local symptoms[46] except for headache which was associated with duration of exposure in years[2]. In opposite with our study, Sandstorm et al. (2001)[36] and Chia et al. (2000)[34], reported that the ear general annoying symptoms among Mph users were strongly associated with the total duration of Mphs use (in hours and years) among users of Mphs.

Conclusion

The study represents the first data about Mobile phone exposure among mobile phone workers. It is concluded that working with Mph led to increase the prevalence of some health problems in the nervous system, ear, and eye. Sleep disturbances, pain & heat sensations around ear and eye allergy were increased with increasing work duration with Mphs in months and with increasing the total duration of exposure to Mphs.

Recommendations

Mph workers must know about the common sense basis for reducing exposure through public information campaigns as TV messages and warning messages on the Mph box and on leaflets in stores selling phone. Replication of the study on a large scale and in other parts of Egypt, with other types of epidemiological studies are needed for further establishment of the perceived health effects among Mph workers.

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